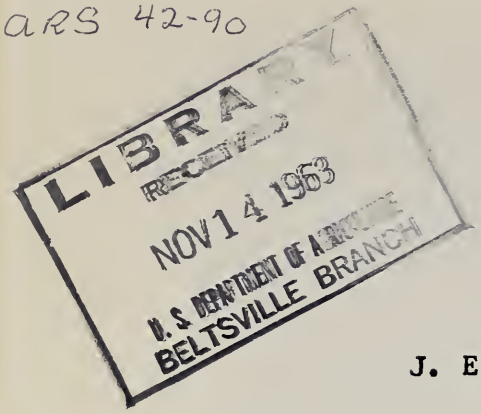


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# TWO MECHANICAL-PICKER ATTACHMENTS FOR HARVESTING COTTON RESEARCH PLOTS[1/]

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## INTRODUCTION

Cotton production scientists have long realized the need for faster and more efficient methods of harvesting research plots. In recent years, progress in mechanization generally and the expansion of cotton research have emphasized the need for new plot-harvesting techniques. With mechanical harvesting spreading rapidly, cotton breeders have had also to consider new methods of evaluating plant performance.

The development of plot harvesting equipment by agronomists and engineers at the Delta Branch of the Mississippi Agricultural Experiment Station received special attention because of the many experiments that are involved in the overall cotton research program. It was evident that a mechanical plot picker would not only speed up harvest operations but also would increase the accuracy and uniformity of data obtained from field experiments. This equipment has provided a practical solution to the harvesting bottleneck.

Plot harvesting equipment has also been devised by other cotton research workers. In the early 1950's, Smith and Brown[3/] developed a sacking attachment in Texas that caught the cotton before it reached the cleaning grates. It consisted of a valve and short duct mounted outside the basket on the cotton discharge duct near the fan. A portable seed cotton scale trailer

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3/ Smith, H. P., and Brown, E. C., Jr. Cotton picker sacking attachment for harvesting small plots. Agricultural Engineering 34:4. April 1953.

for research plots was described by Carter and others in a report published in 1962.4/ This was a weighing device designed for large lots of cotton dumped from the picker basket. An attachment similar to the one described in this report was designed by Carl H. Thomas at Louisiana State University and was used in harvesting research plots.

## DESCRIPTION OF EQUIPMENT

The system of plot harvesting covered in this report centers around specially designed cleaning and bagging attachments mounted inside or in place of conventional cotton picker baskets. On one machine the attachment is placed inside the cotton picker basket with the top removed. The other attachment is built on a platform and is suspended in place of the basket.

The picking attachment on the mechanical picker in figure 1 harvests plot rows up to 100 feet in length and deposits the cotton in sacks in the basket. Several rows can be picked successively without stopping before the sacks are dropped off for weighing and sampling.

Figure 1. Plot picking attachment in use in cotton plots.

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4/ Carter, L. M., Colwick, R. F., and Little, D. E. A portable seed cotton scale trailer for research plots. U.S. Agr. Res. Serv., ARS 42-63, 8 pp. February 1962.

Before installation of the plot picking device, minor modifications were made on the mechanical picker. The basket top was removed, solid flooring was placed over the wire bottom, and a ladder was built for access to the basket. The side of the picker basket was replaced with a hinged board for dumping sacks or for extra storage of filled sacks. The plot picking attachment can be removed and the basket top replaced in about 20 minutes if the picker is needed for general picking.

## Discharge Duct

The rectangular duct was constructed to transport the cotton from the picker into the sack. Cleaning grates inside the duct perform the same function as the basket top grates and allow the excess air and trash to enter the top section of the duct for removal over the rear of the basket. The duct is attached to the front and rear of the basket and fits snugly against the picker discharge duct. The duct was built from 16-gage galvanized sheet metal with angle-iron reinforcing. Some details of construction are shown in figure 2. Cleanout doors in the top of the duct enable easy access to the grates for removing trash accumulations.

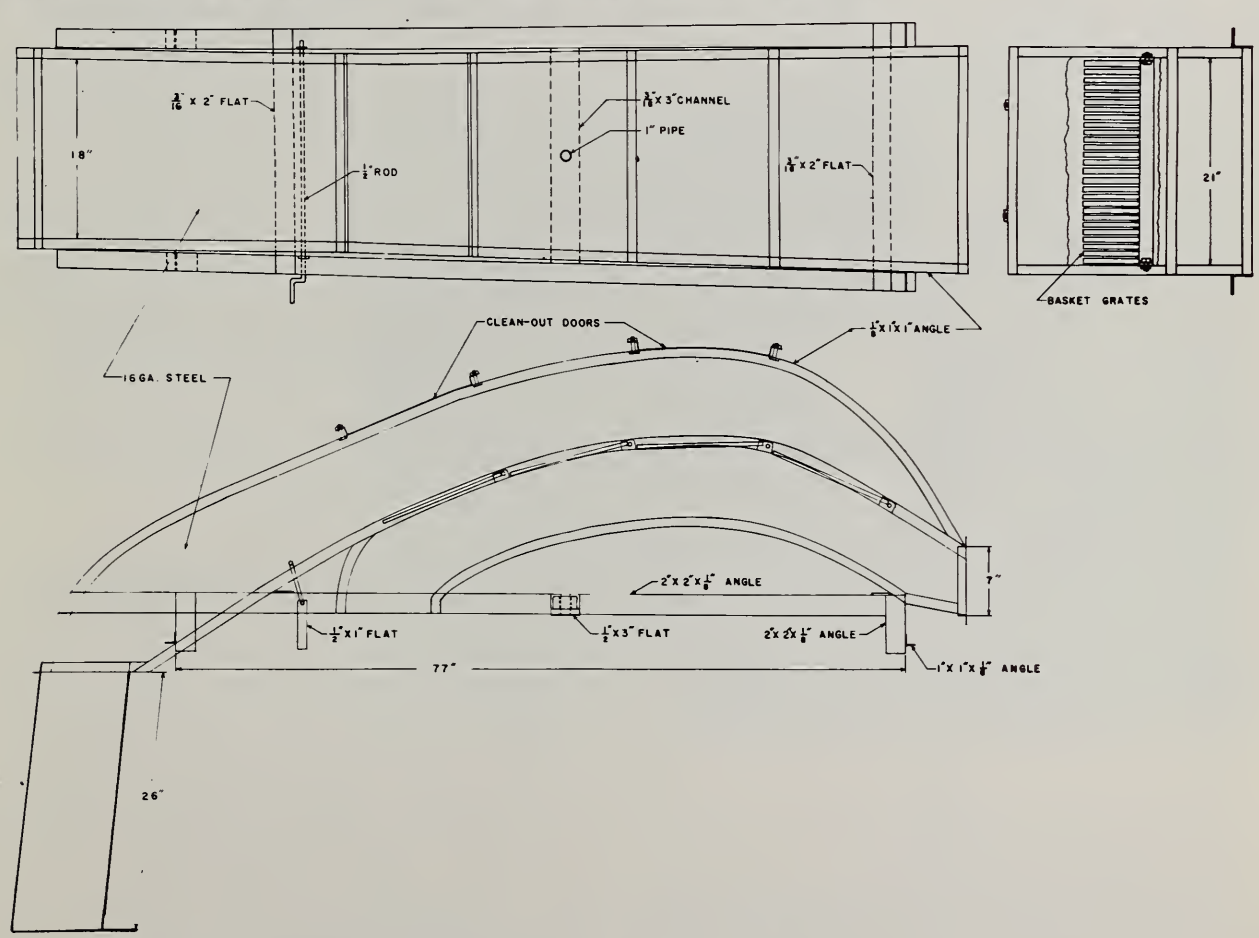


Figure 2. Plot picker duct for conveying, cleaning, and depositing seed cotton.

## Turntable

The sacking turntable is attached to the basket bottom and holds four sacks measuring 38 inches wide and 50 inches long. A spring-loaded side on the sack holder secures the sacks and aids in quick, easy removal and replacement. If the sacks are not uniform in size, hooks may be used to secure them. Air vents in the top of the holder let any remaining air escape from the sack. Figure 3 shows details of the turntable construction.

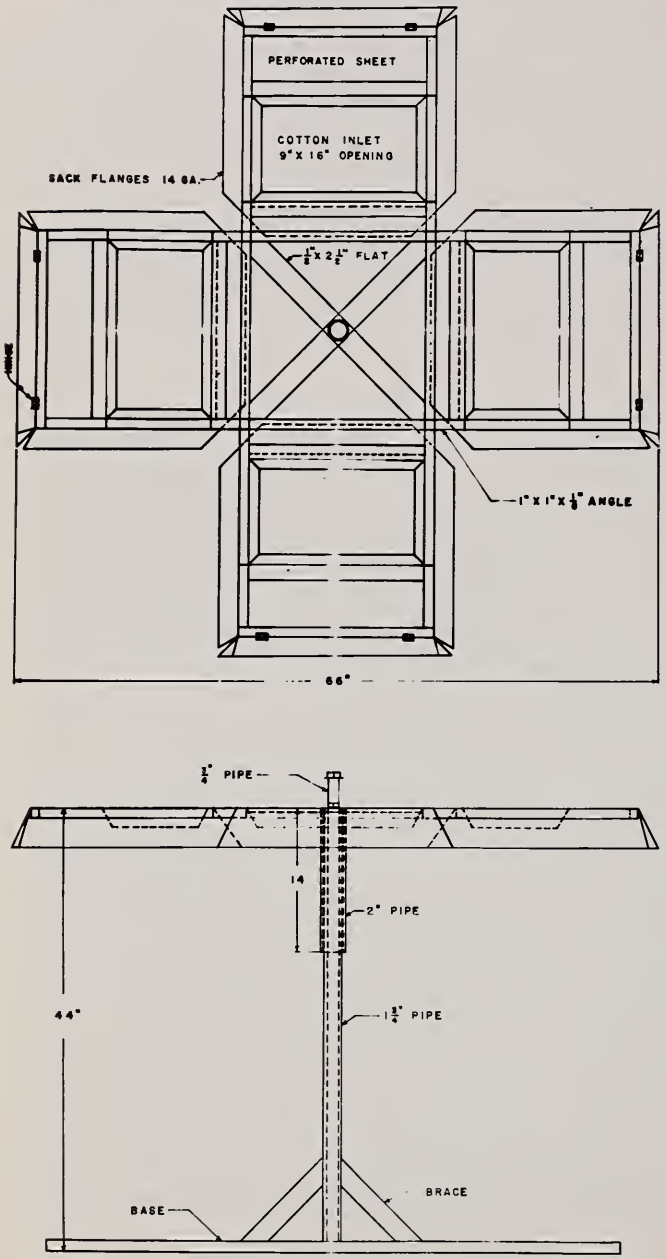


Figure 3. Turntable and base used for attaching and rotating sacks.

### Sacks

The sacks used with the picker are made from 2.11-ounce-per-yard osnaburg material, 40 by 108 inches. They have a rolled hemtop, and measure 38 by 50 inches after sewing. The flanges are made of 16-gage sheet metal and expand the opening from 18 inches square to 19 inches square. Steel rings, 1 inch in diameter, were sewed in four locations around the hemtop for use in picking large plots, when the two rings at the rear were attached to hooks on the flanges. These rings may also be used to hold the sacks after they have been filled (Fig. 1). Cloth sacks with a drawstring may also be used. Figures 4 and 5 show features of the plot picking attachment.

## PLOT LAYOUT AND PICKING PROCEDURE

### General

The mechanical picker and its sacks were designed specifically for harvesting small plots of cotton one row at the time, with one sack used for each plot row harvested. Size of the sacks and capacity of the picker for carrying filled sacks of cotton impose certain limitations on the length of each plot row and on the number of plot rows that can be picked before the filled sacks must be exchanged for empty sacks.

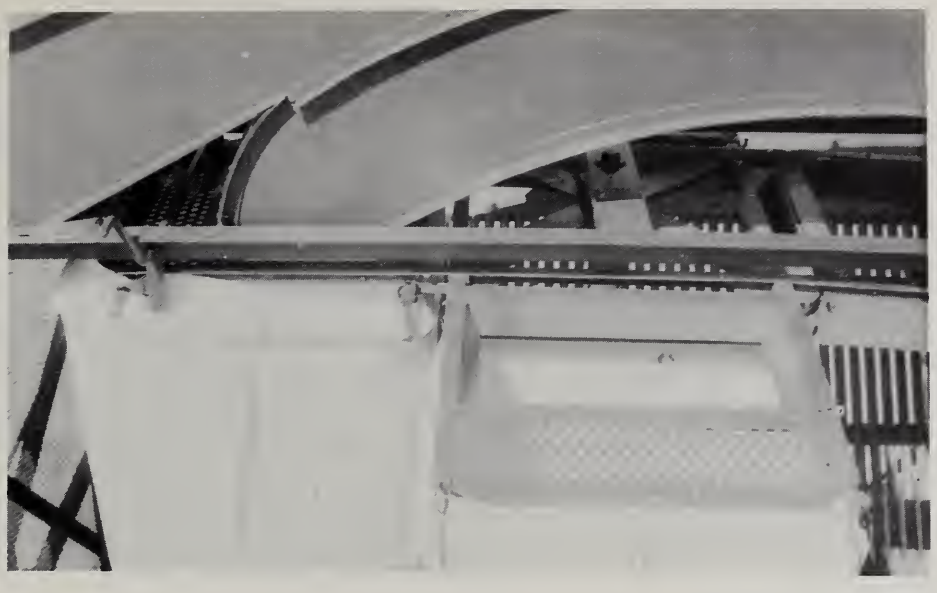

Figure 4. Spring-loaded flanges (four) on the turntable hold sacks securely during picking. Hooks may be used when picking large plots.

Figure 5. Operator in working position in picker basket. Note trash discharge over the rear of the basket.

Filled sacks are exchanged for empties at a weighing and sampling station. The picker can harvest a maximum of 12 plot rows totaling no more than 1,200 row-feet between exchanges of filled sacks for empties. The 38- by 50-inch sacks will hold a maximum of 30 pounds of seed cotton during the harvesting operation and the picker can conveniently hold a maximum of 12 filled sacks of cotton. Thirty pounds of cotton per 100 feet of row is equivalent to 3,920 pounds of cotton per acre, if the row width is 40 inches.

Cotton plots which are harvested mechanically should be laid out so that 20 to 60 rows extending through 1 to 6 or 7 to 12 blocks can be harvested as one land. If six or fewer blocks are in one land, the weighing and sampling station should be on one end of the land so that the picker, in making a round, will harvest no more than 12 plot rows. If 7 to 12 blocks are used, the weighing and sampling station should be at or near the center of the land so that the picker will pass by it twice during each round, and can exchange filled sacks for empties before more than 12 filled sacks are accumulated on the picker.

## Cross and Turning Alleys

An alley width of 10 feet between blocks is sufficient for clearing all cotton from the ducts between plots without stopping. At least 30 feet is required at the ends of each land where the picker has to be turned.

## Number of Rows and Blocks Per Land

Although the picker can operate efficiently in lands containing up to 60 rows, lands of about 40 rows are more convenient. If the lands are excessively wide, too much time is required in turning; if the lands are too narrow, much time is lost in shifting from one land to another. Laying out some experiments in lands of about 20 rows will provide flexibility in that smaller lands can be harvested near the end of the day when time does not permit the harvest of larger ones.

The length of time required to complete a land is primarily dependent on the number of rows and length of the land. A land of 40 rows extending through six 100-foot blocks can be harvested in about three and one-half hours. Attempts to harvest lands requiring seven to eight hours may be hazardous during unsettled weather.

## Operation of the Picker in Small Plots

Several methods of operation are possible, and any one method may need modification to fit particular field designs. For purposes of illustration, an example involving an eight-row land extending through six blocks will be used (Fig. 6). Lands involving more rows would merely require more rounds of the picker, but would not involve any modification in procedure. A picker that harvests the left-hand row of the pair of rows it straddles was chosen arbitrarily. If the picker harvests the right-hand row, the only difference would be that the land would have to be started from the opposite side.

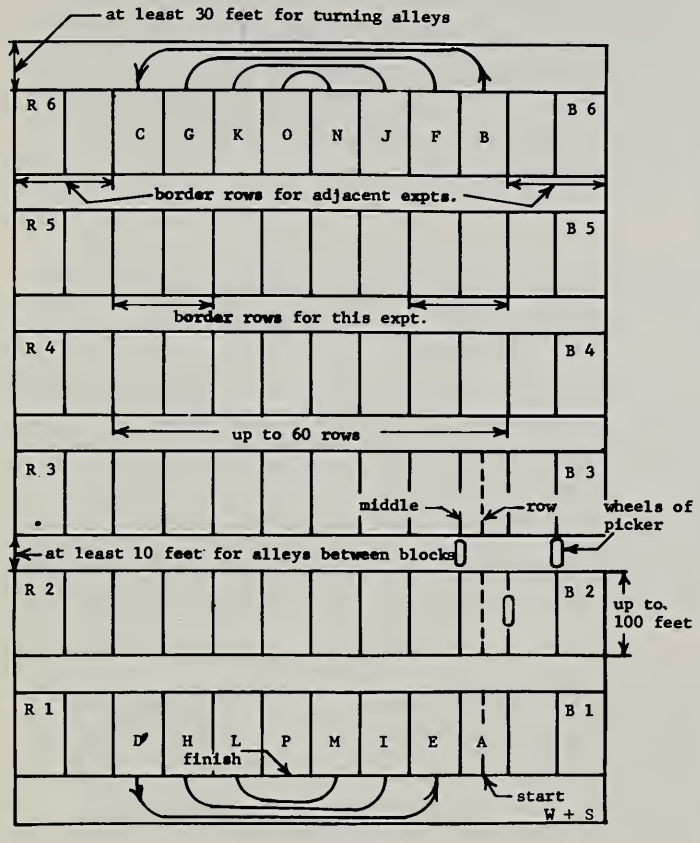


Figure 6. Sample arrangement of individual plot rows for experiments designed for harvesting with the turntable-equipped picker.

Although the land has eight rows, only four of the rows are plot rows. The first pair of rows on each side of the land are guard rows. If the outside pair of rows in each land are guard rows, each plot row will be subjected to contact with the left-hand wheel of the picker during the round just previous to its harvest. No plot row will be straddled by the picker before it is harvested. Use of only one guard row on each side of the land (two between lands) will prevent the preharvest straddling of a row, but will not prevent wheel contact with the outside plot row of the adjacent land that may not be harvested until a later date. If no guard rows are used, or if one guard row is shared by two lands, at least one plot row will be straddled before harvesting and one plot row may escape all contact with the picker before harvesting. Contact with the picker before harvest does knock out a small amount of cotton, particularly if a row is straddled. Bias, resulting from lack of sufficient guard rows, may be less serious in some experiments than in others, but the number of guard rows used should be recognized and considered in checking the harvest results.

The picker is loaded initially with two sets of black numbered sacks, and one set of red numbered sacks. Black one to four are placed on the turntable with black one under the duct. The remaining sacks are placed in one stack in a convenient location in order from top to bottom as follows: Black five, six, red six to one, black one to six.

The picker harvests one row from each block on the outbound trip and one row from each block on the return trip. Black numbered bags are used for plot rows picked when the picker is outbound and red sacks are used for the return trip (RED RETURN). The second set of black sacks is needed on the initial loading only because loading of the turntable for the second round will begin before the picker returns to the point at which filled sacks are exchanged for empties.

After the initial loading of empty sacks, the picker starts harvesting at position A, and moves toward B on the first outbound trip (Fig. 6).

The cotton from guard row A is harvested in sack black 1. At each cross alley and each turning alley the turntable is rotated one-fourth turn counterclockwise to bring the next sack in sequence under the duct. As the picker moves through block 2, the filled black sack 1 is replaced on the turntable by empty black 5, filled black 2 is replaced by empty black 6 in block 3, black 3 is replaced by red 6 in block 4, and so on in a continuing sequence. The filled sacks are hung on hooks on the outside of the picker basket (Fig. 1).

After clearing position B in block 6, the picker is turned and starts the return trip at position C. The picker then harvests in a straight line from C in block 6 to D in block 1. Shortly after the picker enters block 1 on the return trip, a man from the ground crew tosses up 12 empty sacks arranged in order from top to bottom as follows: Red 6 to 1, black 1 to 6.

After the picker leaves position D in block 1, all filled sacks are dropped in the turning alley near the weighing and sampling station (W + S). Black numbered sacks 4 to 6 from the initial loading are then placed on top of the new set of 12 sacks. The picker moves into position E, block 1 to begin the second round of picking. As it moves through block 1, black 4 is placed on the turntable to fully complete the first cycle of the picker. From this point on, the picker merely proceeds successively from position E in block 1 in a decreasing spiral until the land is finished by harvest of the plot row in position P in block 1. Normally the picker can be operated in small plots without stopping to unload, provided two men are stationed in the basket.

## Weighing and Sampling

As the picker begins a cycle at position E, I, and M, the ground crew at the weighing and sampling station (W + S) weighs, samples, empties, and rearranges in proper sequence the 12 sacks dropped near the end of the previous cycle. Weights of seed cotton from each plot row are recorded on a field plan with spaces corresponding to plot rows in the land being harvested. This field plan is very similar to the diagram of figure 6. The weight from the position "M" plot row in block 1 would be written in the space occupied by "M" in the diagram. The sacks of cotton should be weighed in the order in which picked. Consecutively prenumbered storage bags arranged in the picking sequence are needed for identification and storage of samples removed from the picker sacks.

Equipment at the weighing and sampling station includes a trailer for holding the harvested cotton, scales for weighing, a light portable windshield to keep the wind from affecting the scales while sacks are being weighed, and a large board to which the field plan is attached. Scales with a large weighing pan are better than scales on which the sacks must be hooked for weighing. At least three men are needed in the ground crew if the picker is to avoid stoppage at the end of each round. Four men are usually required if samples have to be withdrawn from the bags. One man is required in the trailer for emptying bags. The crew leader weighs, records weights, samples, and rearranges the sacks for return to the picker. Other men in the crew assist the crew leader.

## TWO-WAY VALVE ATTACHMENT

After the development and wide use of the first attachment for picking plots at Stoneville, a different attachment was designed and mounted on another one-row picker. On this machine the picker basket was replaced with a platform to provide more space for storage of the sacks of cotton (Fig. 7).

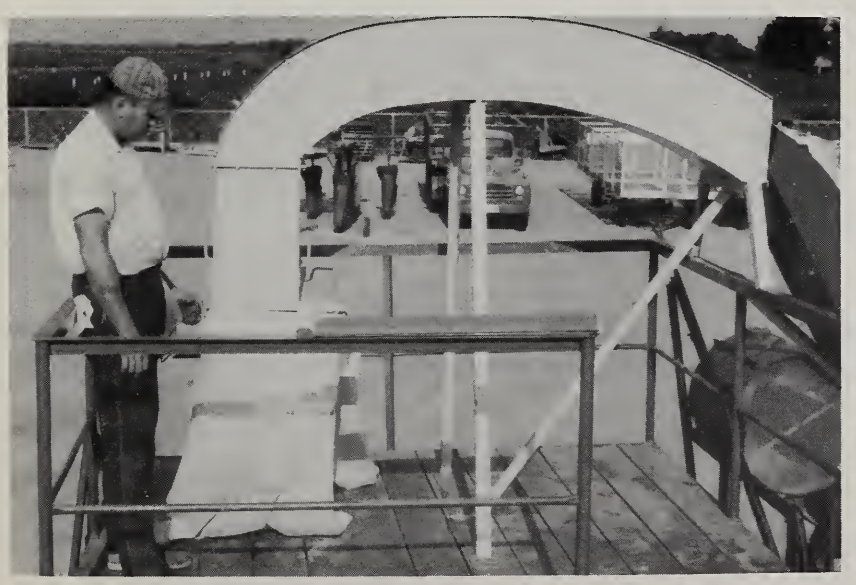

Figure 7. Plot picker constructed by replacing basket with platform and using duct and valve arrangement.

Although a discharge duct similar to the first one was used with this unit, a two-way valve and sacking attachment was used in place of the turntable arrangement (Fig. 8).

Figure 8. Valve and sack attaching flanges on plot picker with platform.

The method of operation is essentially the same for both types of sacking devices. Mounting time required for the two-way valve attachment is approximately 30 minutes, provided a forklift truck is available.

## SUMMARY AND CONCLUSIONS

Of the cotton in plots at the Delta Branch of the Mississippi Agricultural Experiment Station in 1962, about 90 percent was harvested with two mechanical plot pickers. These, described above, are a differently designed sacking arrangement mounted on one-row pickers. They include, respectively, a turntable device and a two-way valve device. Different sacking arrangements were designed and used on the pickers, including (1) a turntable device and (2) a two-way valve device. Principal advantages of the turntable-equipped machine are:

(a) Attachment is more compact and consequently more convenient for operator.
(b) Operator is protected from trash, but this feature could be built into both machines.
(c) Placement of sacks on and off sack holder is more convenient.
(d) Better adapted for use in plots up to 100 feet long. Principal advantages of the machine equipped with two-way valve attachment are:

    (a) Platform gives more work room and a place to store filled sacks.
    (b) Sacks do not have to be lifted over the side of the basket.
    (c) Less cotton is lost in sacking during picking, but the loss during sacking from either machine is less than one percent.
    (d) Better adapted for use in plots over 100 feet long where two sacks per plot row are needed.

Although each machine has certain advantages, the picker with the turntable attachment was generally preferred by most research groups in 1962; however, results of numerous trials showed that either one may be used for most experiments. In all tests the mechanical plot pickers proved far superior to hand picking.

## ACKNOWLEDGMENTS

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